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Impact of Plaque Composition Assessed by iMap™-intravascular Ultrasound on Elevation of High Sensitive Cardiac Troponin T After Percutaneous Coronary Intervention

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Background: It remains unclear whether coronary plaque composition is associated with peri-procedural myocardial injury (PMI) after percutaneous coronary intervention (PCI). This study sought to determine the impact of plaque composition analysis by iMap™-intravascular ultrasound (iMap-IVUS) (Boston Scientific, Boston, MA), a recently developed intracoronary imaging system for tissue characterization, on PMI assessed using a highly sensitive assay for cardiac troponin T (hs-TnT).
Methods: We examined 56 culprit plaques in patients with 52 stable and 4 unstable angina pectoris by iMap-IVUS. The major tissue characteristics at minimal lumen area site were classified by iMap-IVUS as fibrotic, lipidic, necrotic and calcified components, and these are described herein as relative plaque areas. The hs-TnT values were measured before and 24 hours after PCI, and differences were expressed as Δhs-TnT. High hs-TnT elevation was defined as Δhs-TnT level ≥ 0.037 pg/mL of median value. Patients were divided into 2 groups according to the presence (Group I, n = 28) or absence (Group II, n = 28) of high hs-TnT elevation.
Results: Compared with Group II, Group I had significantly higher percent necrotic area (45 ± 12 vs. 35 ± 18%, p = 0.012) and lower percent fibrotic area (42 ± 12 vs. 53 ± 20%, p = 0.016). The percent lipidic and calcified areas were similar between the two groups. Group I also had longer lesion length (17.9 ± 9.9 vs. 13.0 ± 4.9 mm, p = 0.024), a lower frequency of direct stenting (18 vs. 54%, p = 0.011), and a higher frequency of post-dilation (89 vs. 61%, p = 0.014) than Group II. The Δhs-TnT level correlated positively with percent necrotic area (r = 0.40, p = 0.003), lesion length (r = 0.31, p = 0.021), and negatively with percent fibrotic area (r = -0.35, p = 0.008). In multivariate logistic regression analysis, a larger percent necrotic area (odds ratio [OR], 1.08; 95% confidence interval [CI], 1.02 - 1.14; p = 0.005) and less direct stenting (OR, 0.11; 95%CI, 0.025 - 0.51; p = 0.005) were independent predictors of high hs-TnT elevation.
Conclusions: Plaque composition analysis by iMap-IVUS is useful to predict the elevation of hs-TnT after PCI.

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Impact of pre-diabetic status on coronary atherosclerosis: a multi-vessel angioscopic study

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Background: Although diabetes mellitus is a major risk factor of coronary artery disease (CAD), there is no evidence that pre-diabetes including impaired fasting glucose and impaired glucose tolerance is associated with atherosclerosis of coronary artery. Angioscopy can identify vulnerable plaques as intense yellow plaques.
Methods: Sixty-seven patients with angina pectoris who undergoing angioscopic observation for plural main trunks of coronary arteries were enrolled. According to the American Diabetes Association guideline, patients were divided into 3 groups; non-diabetes (n=16), pre-diabetes (n=28) or diabetes (n=23). Color grade of coronary plaque was defined as grade 1 (light yellow), grade 2 (yellow), and grade 3 (intense yellow) based on angioscopic findings. Number of yellow plaque per vessel and maximum yellow grade were evaluated.
Results: There were no significant difference of baseline characteristics including low-density lipoprotein cholesterol among non-diabetes, pre-diabetes, and diabetes. Total number of yellow plaque significantly differed between the three groups (0.80±0.64, 1.45±0.81, and 1.63±0.99; P=0.01, respectively). Similarly, maximum yellow grade was different (1.44±1.03, 2.00±0.86, and 2.30±0.70; P<0.05, respectively). The two indexes of pre-diabetes were higher than those of non-diabetes (P=0.02, and P=0.04, respectively), while they were similar between pre-diabetes and diabetes (P=0.44, and P=0.21, respectively). Multivariate logistic regression analysis showed that not only diabetes but also pre-diabetes were independent predictors of multiple yellow plaques [OR: 12.8, 95% CI: 2.26-72.2, P=0.004 and OR: 4.86, 95% CI: 1.11-21.3, P=0.04, respectively].
Conclusions: The degree of coronary atherosclerosis in patients with pre-diabetes patients was more advanced than those with non-diabetes, and plaque vulnerability on angioscopy was similar between pre-diabetes and diabetes. Slight or mild disorder of glucose metabolism, such as pre-diabetes may be a risk factor of CAD as well as diabetes.

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Patient and lesion characteristics of peripheral artery disease concomitant with coronary artery disease: Insights from Virtual histology intravascular ultrasound analysis

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Background: It is well known that lower extremity peripheral artery disease (PAD) is closely related to coronary artery disease (CAD). However, a detailed relationship between CAD and patient and lesion characteristics of PAD remains still unclear.
Methods: In this study, we enrolled 154 patients who underwent endovascular therapy for femoro-popliteal artery. Subjects were assigned to two groups based on CAD status (99 patients with CAD and 55 without CAD). The clinical characteristics (risk factor, medication, other comorbidities, and serum biomarkers) between the two groups were compared. Of the all subjects, 66 patients with culprit lesions investigated using virtual histology intravascular ultrasound (VH-IVUS). The percentage of stenosed area (%Stenosis) and four plaque components (%Fibrous, %Fibro-Fatty, %Necrotic-Core, and %Dense-Calcium) of the minimal lumen area were evaluated. These participants were assigned to two groups based on CAD status (46 patients with CAD and 20 without CAD), and chronic total occlusion (CTO) lesions (30 patients with CTO lesions and 36 without CTO lesions) to compare the VH-IVUS parameters.
Results: Analysis of the patient characteristics revealed that hyperlipidemia, (p = 0.021), chronic kidney disease (p = 0.023), and statin use (p = 0.014) were significantly high and smoking (p = 0.023) and high-density lipoprotein cholesterol level (p = 0.025) were low in the CAD group. The VH-IVUS analysis showed no change in %Stenosis, although %Necrotic-Core was significantly high and %Fibro-Fatty was low in the CAD group (%Necrotic-Core: 29.7 ± 11.6 vs 21.4 ± 11.4, p = 0.009; %Fibro-Fatty: 9.4 ± 7.8 vs 18.1 ± 15.8, p = 0.004). In the CTO group, despite no change was found in %Stenosis either, %Necrotic-Core was significantly high and %Fibro-Fatty was low (%Necrotic-Core: 30.4 ± 10.9 vs 24.5 ± 12.5, p = 0.044; %Fibro-Fatty: 7.9 ± 5.5 vs 15.4 ± 13.8, p = 0.007).
Conclusions: PAD concomitant with CAD may promote progression of other comorbid diseases, possibly leading to increased vulnerability to the peripheral artery plaque.

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Epicardial fat volume and coronary plaque characteristics

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Background: Unlike subcutaneous fat, epicardial fat has a higher secretion of inflammatory cytokines. Recent study have shown that epicardial fat volume (EFV) may be linked with the development of coronary atherosclerosis. The aim of this study is to assess the relationship of EFV and plaque vulnerability using a 40MHz IVUS imaging system (iMap-IVUS) in significant coronary stenotic lesion.
Methods: We analysed consecutive 118 patients (73 men and 45 women, mean age 70.0 ± 9.51 years) with suspected coronary artery disease who underwent 64-slice dual-source CT (DSCT) and cardiac catheterization. Culprit lesions were imaged by iMap-IVUS before stenting. The iMAP-IVUS system analyzed coronary plaques as fibrotic, lipidic, necrotic, or calcified tissue based on the radiofrequency spectrum. Cross-sectional computed tomographic cardiac slices (1.0mm thick) from base to apex were traced semiautomatically. Using a 3D workstation (Ziostation; Amin, Tokyo, Japan), EATV was measured by assigning Hounsfield units ranging from -190 to -30 and was obtained as the sum of fat areas on short axis images.
Results: EFV was 67.6±22.8 (range, 20..8 to 112.8ml). A positive correlation was found between EFV and the percentage of necrotic plaque (r=0.38, p=0.016). However, significant correlation was not observed between EFV and the percentage of fibrotic plaque (r=0.22, p=0.182), lipidic plaque (r=0.20, p=0.214), or calcified plaque (r=0.04, p=0.852). Additionally, multivariate analysis by linear regression (adjustment for age, BMI, LDL cholesterol level) revealed that increased EFV remained as an independent parameter associated with the percentage of necrotic plaque (r=0.34, p=0.023).
Conclusions: Our data showed that increased EFV was associated with the development of coronary atherosclerosis and potentially the most dangerous type of plaques. The measurement of EFV using cardiac computed tomography before percutaneous coronary intervention may be a useful marker for detecting the presence of vulnerable plaques.